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Digital technology, digital capability and organizational performance: A mediating role of digital innovation

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A mediating role of digital innovation

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Abstract

Purpose – Despite the growing importance of digital innovation conceptualized as innovative digital solutions that enable digital transformation of businesses across industries, empirical study of factors related to digital innovation is still scant, creating a knowledge gap. To fill this gap, this paper aims to examine the effect of digital orientation and digital capability on digital innovation, and also the mediating effect of digital innovation on the link between organizational performance and digital orientation as well as digital capability.

Design/methodology/approach – This study tests a new conceptual framework using a survey data of 105 small to medium-sized IT firms in Malaysia and employing structural equation model (SEM) analysis from partial least square (PLS) approach.

Findings – The results show that digital orientation and digital capability have positive effect on digital innovation and also that digital innovation mediates the effect of technology orientation and digital capability on financial and non-financial performance.

Practical implications – The findings encourage the firms to take the opportunity of emerging digital technologies and digitalization trend in industries by being committed toward embracing new digital technologies and upgrading their digital capabilities to become innovation leaders and also to boost firms' performance.

Originality/value – This study is one of the first studies that explain how emerging digital technologies can be leveraged to create innovative digital products and services and subsequently boost their business performance. It also fills the literature gaps related to driving factors of digital innovation and mediating role of digital innovation on the link between its driving factors and performance.

Keywords Malaysia, Digital technology, Organizational performance, Digital innovation, Digital capability

Paper type Research paper

1. Introduction

Digitalization of business firms across industries enabled by new digital technologies such as IoT, big data analytics, artificial intelligence and cloud computing is an emerging phenomenon. The firms must succeed in embracing transformation through digital technology to enable major business improvements such as enhancing customer experience and engagement, streamlining operations and creating new business models or they will face destruction at the hands of their competitors that do (Fitzgerald *et al.*, 2014). For business firms to digitalize their product, service, or business function, they need to

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integrate new digital solutions such as market intelligence software that uses artificial intelligence (AI) technology to identify what is trending among the target customers, which helps the organizations to customize their product offerings accordingly. Another digital solution, a custom mobile app used by Tesco outlets in South Korea allow customers to scan the codes of virtual groceries in virtual stores while waiting at train stations. The groceries are then delivered to the purchaser's homes. This digital offering boosted the Tesco's online sales. In view of the benefits offered by digitalization, innovative digital solutions are regarded as crucial enablers of digitalization of businesses across industries in various functions such as marketing, customer service, human resource management, logistics and production. Therefore, without embracing innovative digital solutions, systems and support provided by IT firms that play an important role in digital ecosystem, business firms are far from ready for digital transformation.

In this sense, digital innovation could be conceptualized as innovative IT solutions that integrate emerging digital technologies to support the digitalization of non-tech businesses such as banking, health care, manufacturing, retail. Along with the increasing importance of digitalization, digital innovation has become an important research agenda due to the rising need for novel digital solutions. Despite the growing research interest in digital innovation, literature on digital innovation is still in an infancy stage. Most of the studies on digital innovation look at innovation from a technical, architectural or information system perspective (Wroblewski, 2018; Lyytinen *et al.*, 2016), but not from a managerial perspective. Moreover, the context of those studies is mostly in general industries, but not IT (Eidhoff *et al.*, 2016; Häikiö and Koivumäki, 2016). Hence, this study takes a different approach to digital innovation by choosing the IT context to see how IT products or solutions are transforming into innovative digital products or solutions that subsequently transform other traditional business, products and services and even create new businesses. Moreover, no study was found to have explained how digital technologies can be leveraged by IT companies to make innovative digital products and services. Although many studies have examined the contributing factors of innovation in various industries, there is a lack of literature on driving factors of innovation of digital products in IT industry. This study addresses these literature gaps by raising the first research question:

RQ1. What factors drive digital innovation?

We draw on resource-based theory and its extension – dynamic capabilities theory to address this research question by building and testing a conceptual framework. In the context of Malaysia, a research conducted by International Data Corporation (IDC) reported that 78 per cent of firms surveyed find lack of commitment and limited capabilities as factors which impede their digital transformation journey (Ramu and Chu, 2018). Although digital technologies offer new opportunities to both technological (such as IT firms) and non-technological organizations (such as bank, manufacturing, retail), the digital innovation cannot be achieved without serious commitment to emerging technologies. Gatignon and Xuereb (1997) note that a firm wishing to develop an innovation superior to the competition must have a strong technological orientation. They define technology orientation as a firm's commitment to the application of new technology and responsiveness toward technological changes. In view of emerging digital technologies, firms should be orientated toward embracing digital technologies to transform them into innovative digital solutions.

Besides the importance of orientation toward digital technology adoption, a firm also need to have capability to manage and make the best use of digital technology in innovation process because capability expedite innovation process by integrating and mobilizing both human and technological strengths and resources. A study by Liu *et al.* (2011) states that

managing digital transformation can be challenging, but preparedness for resources and capability are necessary. Teece (2013) contends that the dynamic capability approach provides organizations with a coherent framework for developing and managing capabilities in a way that will build competitive advantage. In the case of digital innovation, digital capability is necessary to integrate digital technologies with digital talent of professionals. Drawing on dynamic capability theory, digital capability could be considered as dynamic capability, described as an organization's ability to create new products and processes and respond to changing market circumstances (Teece and Pisano, 1994). Moreover, digital capability complements digital orientation of a firm because only the firms with skill to manage new technologies will be ready to adopt those technologies and able to commit toward converting the technologies into new products. Likewise, digitally capable firms also need to have commitment and readiness toward embracing new technology to develop new products that brings competitive advantage. Hence, we contend that digital capability and digital orientation are compatible and complement each other in achieving product innovation because innovation is proven to be triggered by technology orientation (Zhou and Li, 2010) and enabled by technological capability (Renko *et al.*, 2009).

Prior literature has supported technological capability-innovation and technology orientation-innovation links (Gonzalo *et al.*, 2018; Al-Ansari *et al.*, 2013; Gatignon and Xuereb, 1997; Zhou and Wu, 2010). On the other hand, significant literature has supported the positive relationship between innovation and organizational performance (Yang *et al.*, 2012; Sainio *et al.*, 2012; Hortinha *et al.*, 2011). In the context of digital technology, scarce evidence was found on the relationship between digital innovation and organizational performance. For example, Bughin and Zeebroeck (2017) find evidence that companies that try to tap their full digital potential gain the most and their returns are higher compared to the average firm, and technology orientation as well as technology capability. Therefore, it is possible that digital orientation and digital capability may have indirect, rather than direct, effect on organizational performance, via innovation that could play a mediating role. This raises our second research question:

RQ2. Does digital innovation translate digital orientation and digital capability into better organizational performance?

Moreover, the substantial relationship between digital technology factors and performance has not been well-established empirically, especially in digital technology context. For example, a study of Swedish firms by Wroblewski (2018) suggests that digital maturity is weakly and negatively associated with firm operating performance. Hence, there is a need to examine establish the relationship between digital capability, orientation, innovation and performance in the context of IT firms.

To answer the research questions, this study is conducted with two objectives: first, to examine the direct effect of digital orientation and digital capability on innovation; and second, to examine the mediating effect of digital innovation on the link between organizational performance and digital orientation, as well as digital capability in the context of IT firms in ICT (Information, Communication and Technology) sector of Malaysia. IT firms are mostly small and medium enterprises (SMEs), and provide digital products and services in the form of software, hardware, and IT services. The significant contribution of ICT sector to economy in terms of GDP has been reported as 16.2 per cent in 2016. In Malaysia, the digital solutions such as fintech, healthtech and business analytics, business intelligence software are some of the promising innovative digital solutions that have started to digitalize the industries.

This study makes contributions to existing body of knowledge on digital innovation. *First*, it offers a new conceptual framework that links digital innovation to both the driving factors and performance outcome. By testing the framework, this study fills the literature gap by providing empirical evidence of relationships between the driving factors and performance impact of digital innovation. *Second*, the current study is one of the first studies to examine the related factors of digital innovation particularly in the context of IT firms. It is important to add knowledge on digital innovation in the context of IT firms because IT firms' innovative digital solutions are crucial enablers of digitalization of industries. *Third*, this study introduces new terms – digital orientation and digital capability, which could be further extended and conceptualized as key constructs for digital innovation. Contextualizing these terms is important because there is a need to maximize the relevancy of concepts to the context due to the distinctive and disruptive nature of the emerging digital technologies.

The remaining of this paper is structured as follows. Section 2 discusses the conceptual background and hypotheses development based on literature review. Section 3 describes the methodology, including sampling, measures for survey questionnaire and profile of the respondent firms. Section 4 explains the results of data analysis for both measurement model and structural model, indicating which hypotheses are supported. Section 5 provides discussion and implications based on the results of this study, followed by Section 6 that indicates limitations and future research recommendations. Finally, Section 7 concludes the paper.

2. Conceptual background and hypotheses

2.1 Digital innovation

In general context, digital innovation is defined by Nambisan *et al.* (2017) as the creation of market offerings, business processes or models that result from the use of digital technology. Their definition includes a range of innovation outcomes, such as new products, platforms and services as well as new customer experiences and other value pathways; as long as these outcomes are made possible through the use of digital technologies and digitized processes. In this study, digital innovation is contextualized into innovative digital solutions that transform other organizations' products, service and business. Hence, we define digital innovation as "the development of new products, services, or solutions by using digital technology". The digital technology used in innovation have been identified by Urbinati *et al.* (2018) as Big Data, Internet of Things (IoT), Cloud Computing, augmented and virtual reality, artificial intelligence and cyber-physical systems. On the other hand, digital technology is defined by Fitzgerald *et al.* (2014) as social media, mobile, analytics or embedded devices.

To understand the nature of digital innovation, Yoo *et al.* (2010) suggest to consider how digital technology differs from earlier technologies, noting three unique characteristics:

(1) the reprogrammability;

(2) the homogenization of data; and

(3) the self-referential nature of digital technology.

One of the examples of digital innovation in the context of IT products is IKEA's augmented reality app that works like a virtual interior designer and allows customers to visualize 3D versions of its furniture in their homes. Some studies have highlighted how digital technology is used in the process of innovation to increase the productivity or to get better access to customers or reduce operation costs. For example, Boss *et al.* (2007) have

highlighted how companies can use Cloud Computing to quickly develop, test and make their innovations available to the user community, because it enables faster deployment cycles of new products and services.

Recent research by Henfridsson *et al.* (2014) highlights how the unique properties of digital technology enable new types of innovation processes that are distinctively different from the analog innovation processes of the industrial era. However, their study focuses on digital technology of digitalized physical products, but not the mainstream IT products. Only a scant literature is available on conceptualizations of digital innovation and its driving factors and outcomes. A qualitative study of respondents from eight sectors in Germany by Eidhoff *et al.* (2016) indicate that the most critical factors for a company's decision to pursue digital product innovation can be found in the technological and environmental dimensions. In view of limited literature on digital innovation, there is a need for empirical evidence of driving factors in digital innovation in IT industry context. Hence, we draw on resource-based theory and its extension: dynamic capabilities theory to conceptualize digital orientation and digital capability as driving factors of digital innovation.

2.2 Digital orientation and digital innovation

The management literature emphasizes the importance of having a high commitment to technology in responding to changing technological conditions (Al-Ansari *et al.*, 2013). The resource-based view (RBV) has been widely used within the innovation literature to explain how firms are able to gain competitive advantage and superior performance. The tenet of the theory is that superior firm performance is attributable to resources and skills that are firm-specific, rare and difficult to imitate by rival firms (Barney, 1986). We draw upon RBV to conceptualize technology orientation toward new digital technology trends as an important asset for IT firms as they will lose out if they do not embark on new digital technologies. This study conceptualizes digital orientation based on Gatignon and Xuereb (1997) who define technology-oriented firm as a firm with the ability and the will to acquire a substantial technological background and to use it in the development of new products. They also keep themselves relevant to new technologies; thus, they could develop new products that are innovative. In this study, digital orientation is conceptualized as technology orientation in digital technology context and is defined as "a firm's commitment toward application of digital technology to deliver innovative products, services, and solutions". Based on this definition, digitally oriented firms are more open to digital technologies and tend to embrace digital initiatives quickly with commitment.

As an extended term of technology orientation, digital orientation is a new concept and thus, only a dearth of related literature could be found. Hence, literature on technology orientation is referred and contextualized in this study, as both terms carry the same concept. Some interesting research findings could be noted for technology orientation-innovation relationship. While some researchers have found a positive relationship between technology orientation and product innovation (Yang *et al.*, 2012; Hortinha *et al.*, 2011), others found conditional relationships (Spanjol *et al.*, 2011; Salavou, 2005; Zhou *et al.*, 2005). Zhou *et al.* (2005) found that technology orientation was associated positively with technology-based innovation but had no effect on market-based innovation. In view of some inconsistent findings, Khin *et al.* (2012) call for more empirical test of positive effect of technology orientation on innovation. Drawing on resource-based theory, the literature posits that firms with superior technology orientation achieve greater level of innovation because they have a greater vision and commitment toward using new technologies to develop innovative products. Especially for digital-driven innovation, digital technology is

the starting point and driving force in the digital innovation process. Without being dedicated to technological trends and adopting suitable digital technology, a firm would not be capable of developing an innovative solution that suits current business trends. In view of above rationalization and literature support, this current study contends that digitally-oriented firms are more likely to produce digital innovations. Therefore, we hypothesize as follows:

H1. Digital orientation has a positive effect on digital innovation.

2.3 Digital capability and digital innovation

Technological skills and competence are important resources required for the innovation process (Freel, 2005; Renko *et al.*, 2009). No matter how well technology has been deployed within an organisation its usage and services still need to be managed effectively and efficiently (Lu and Ramamurthy, 2011). Moorman and Slotegraaf (1999) define technological capability as a firm's technological ability to formulate and develop new products and related processes. In the context of digital products, digital capability could be defined as "a firm's skill, talent, and expertise to manage digital technologies for new product development". Carcary *et al.* (2016) suggest that successful digital transformation requires an organization to develop several capabilities in many different areas and these capabilities may differ depending on the particular sector and the specific needs of the organization. Levallet and Chan (2018) identified two key digital capabilities: a well-developed information management capability and a flexible IT infrastructure, but did not link them to innovation.

The dynamic capability view of the firm identifies dynamic capabilities as the main source of sustainable competitive advantage in a changing competitive landscape (Teece and Pisano, 1994; Teece *et al.*, 1997). Dynamic capabilities are defined as 'the subset of competence/capabilities, which allow the firm to create new products and processes, and respond to changing market circumstances' (Teece *et al.*, 1997). Although significant body of research has supported the technology capability-innovation relationship from both resource-based and dynamic capability theory, only a few studies have supported the impact of digital capability on digital innovation. For example, a study conducted by Westerman *et al.* (2012) reveals that digital capabilities are a fundamental building block with which companies can transform customer experience, operational processes and business models. The authors found that 77 per cent of respondents mentioned skills gaps as a hindrance to digital transformation. They suggest that digital skills need go beyond pure IT to include specific technologies such as social media or mobile, as well as the analytic skills to drive value from big data.

Although literature on digital capability that links to innovation in emerging digital technology context is still scare, positive impact of technological capability on innovation has received widespread support (Zawislak and Alves, 2013; Zhou and Wu, 2010; Renko *et al.*, 2009). As a technological capability in digital context, digital capability is an important requirement to achieve digital innovation because the success of digital product development is highly dependent on how well a firm could manage digital technologies. Every step involved in digital innovation from acquiring the digital technology, and developing new digital solutions need optimal level of capabilities by talented professionals. Grounded on this argument and dynamic capability theory, this study proposes as follow:

H2. Digital capability has a positive effect on digital innovation.

2.4 Mediating role of digital innovation

Technological innovation is regarded as a major strategic tool for enterprises to enhance competitiveness and performance. The positive impact of innovation on performance has been evident in the past literature (Valmohammadi, 2017; Choi *et al.*, 2013; Ussahawanitchakit, 2012). However, a few studies posited the negative impact of product innovation on performance (Damanpour and Evan, 1990; Laforet, 2011). In digital technology context, some mixed findings could be observed. Westerman *et al.* (2011) found that profitability and revenue generation are higher for firms with above average digital innovation values. Similarly, Weill and Woerner (2015) report an increase of revenue growth and profit margins for companies that are embracing digital technology and operate within the digital ecosystem. Therefore, research findings of digital innovation–performance link are contradictory and probably, context-dependent.

On the other hand, Chae *et al.* (2014) found no relationship between IT capability and organizational performance. Their study called for future researchers to identify and incorporate other variables that potentially affect the relationship between IT capability and business performance. In response to this call, we contend that innovation could be the factor that may affect the relationship between a firm's digital capability and business performance because the link between digital capability and organizational performance has not been established yet particularly in the context of IT firms. In addition, only a dearth of studies has considered the mediation effect of product innovation on the relationship between performance and technology orientation (Lestari *et al.*, 2013) as well as technological capability (Al-Ansari *et al.*, 2013) separately. Al-Ansari *et al.* (2013) advise managers to consider innovation as a mediating factor for technology orientation to achieve better business performance. On the other hand, the direct effect of technology orientation on innovation (Yang *et al.*, 2012; Sainio *et al.*, 2012; Hortinha *et al.*, 2011) and that of technological capability on innovation (Zhou and Wu, 2010; Benedetto *et al.*, 2008) have been established. However, no study was found to have tested the mediating effect of innovation on the link between these two factors and performance in digital context. Therefore, limited evidence of indirect effect of technology orientation and capability on performance though innovation warrant us to examine the mediation effect of digital innovation on digital orientation-performance and digital capability-performance links. The rationale behind the mediation effect of innovation is that a firm with a strong digital orientation and digital capability is in a better position to deliver innovative offerings to satisfy the customers better, thereby increasing the sales and financial return. Based on this rationale, we argue that digital innovation plays a mediating role by translating digital orientation and digital capability into better performance. Hence, we hypothesize as follows:

H3. The effect of digital orientation on financial performance is mediated by digital innovation.

H4. The effect of digital orientation on non-financial performance is mediated by digital innovation.

H5. The effect of digital capability on financial performance is mediated by digital innovation.

H6. The effect of digital capability on non-financial performance is mediated by digital innovation.

3. Method

To achieve research objectives and also to answer research questions, this study used quantitative methods to examine relationships between variables by collecting and analyzing the survey data to test the hypotheses. The unit of analysis of the current study is the IT firm that engages in digital technology. This section explains about sample, why IT firms in Malaysia were selected, selection criterion, and how the data were collected.

3.1 Sample and data collection

To examine the relationships between the variables by testing the hypotheses, a cross-sectional data were collected from 105 SMEs in ICT industry in Malaysia. Malaysia and IT firms were selected for two reasons. One reason is that Malaysia is moving toward digital economy and IT firms and their innovative digital solutions play important roles in digital transformation of industries. Another reason is that the there is a pressing need to investigate how digital innovation can help IT firms in achieving better business performance and in turn contribute to GDP and digital economy. ICT industry is made up of segments such as software, devices, IT services, and communication services.

The selection criterion for responding firms was that the firms must be locally owned SME in ICT sector with sales turnover not exceeding RM20m or number of full-time employees not exceeding 75. The data were collected primarily by means of a Web-based survey. Contacts of the firms were acquired from PIKOM, The National ICT Association of Malaysia. First, phone calls were made to identify the right respondents from the firms and to get their emails. Next, emails with a cover letter and the online link to the survey were sent to the potential respondents. Out of 380 potential firms we sent emails, only 105 firms responded to the survey at the response rate of 27 per cent. In this study, the response-bias analysis was deemed unnecessary due to the negligible number of late responses.

3.2 Measures

Following a comprehensive investigation of existing literature, and interviews with IT professionals who have extensive knowledge of digital technology and innovations, we designed our survey instrument. Some questionnaire items were reworded to suit the digital context as shown in Table I. To measure digital orientation, this study adapted the measures of Zhou *et al.* (2005), who adapted the original measures of Gatignon and Xuereb (1997). The items assess a firm's commitment in using digital technologies in new product development as well as their tendency to take digital opportunity. There were four items for digital orientation, measured by five-point Likert-like scale ranging from 1 = "strongly disagree" to 5 = "strongly agree". With respect to digital capability, this study adapted the measures of Paladino (2007). There were five items for digital capability, measured by a five-point Likert-like scale ranging from 1 = "very low" to 5 = "very high" to self-assess the respondent firm's capability related to application of digital technology.

To measure digital innovation, this study adapted the measures of Paladino (2007). There were six items using a five-point Likert-like scale ranging from 1 = "strongly disagree" to 5 = "strongly agree". The questions were adapted to suit the research context in digital innovation. This study used both financial and non-financial items to measure the organizational performance. These were measured using five-point Likert-like scales ranging from 1 = "not at all satisfied" to 5 = "very satisfied". The financial measures assess

Questionnaire items	Source
Digital innovation	
The development of new products, services, or solutions by using digital technology	
Digital technology	
Emerging technologies such as Big Data, Internet of Things (IoT), Cloud Computing, augmented and virtual reality, artificial intelligence (AI), and cyber-physical systems	
Digital innovation	
The quality of our digital solutions is superior compared to our competitors'	Paladino (2007)
The features of our digital solutions are superior compared to our competitors'	
The applications of our digital solutions are totally different from our competitors'	
Our digital solutions are different from our competitors' in terms of product platform	
Our new digital solutions are minor improvements of existing products	
Some of our digital solutions are new to the market at the time of launching	
Digital orientation	
Please indicate your level of agreement or disagreement with the statements below	Zhou *et al.* (2005) Gatignon and Xuereb (1997)
We are committed to use digital technologies in developing our new solutions	
Our solutions have superior digital technology	
New digital technology is readily accepted in our organization	
We always look out for opportunities to use digital technology in our innovation	
Digital capabilities	
Please indicate the level of your company's capabilities in following areas	Zhou and Wu (2010)
Acquiring important digital technologies	
Identifying new digital opportunities	
Responding to digital transformation	
Mastering the state-of-the-art digital technologies	
Developing innovative products/service/process using digital technology	
Subjective performance	
Please indicate your level of satisfaction with your company's performance	
Sales	
Net profit	
Cash flow	
Objective performance	
Customer satisfaction	
Market share	
Employee turnover	

Table I.
Measurement items

their satisfaction level with sales, net profit and cash flow, whereas non-financial measures assess that of customer satisfaction, market share and employee turnover.

3.3 Profile of responding companies and respondents

The respondent firms dealt with a variety of software and hardware solutions used for manufacturing, retail, insurance, banking, education and health care. Out of 105 firms, 40.2 per cent were located in Kuala Lumpur, followed by 30 per cent in Selangor and 20.5 per cent in Pulau Pinang. As for the firm size, 93 per cent had less than 50 employees. The age of the firms shows that 60.6 per cent had been in operation for between 5 and 10 years and the rest were less than 5 years. The majority of the respondents were found to be business owners (40 per cent), followed by directors (29.7 per cent) and the rest were managers.

4. Analysis and results

In this study, SPSS Version 20 was used for data screening, profiling of respondent firms, and the common method variance. To test the hypothesis, SmartPLS software, developed by Ringle *et al.* (2005), was used by means of structural equation model (SEM) from partial least square (PLS) approach. One advantage of PLS is that it enables the researcher to simultaneously examine a series of interrelated dependence relationships among the measured variables and latent constructs as well as between several latent constructs. Moreover, PLS method demands significantly fewer requirements on sample size and distribution compared to covariance analyses, does not require normal-distributed input data but, nevertheless delivers consistent and reliable results and can be applied to complex structural equation models with a large number of constructs (Urbach and Ahlemann, 2010).

This study used the two-step approach to analyze the measurement model first, and structural model second as suggested by Anderson and Gerbing (1988) and Chin (2010). The purpose of this approach was to assess the fit and construct validity of the measurements first before assessing the structural model for path coefficients or relationships between the constructs. Before assessing the measurement and structural model results, common method variance test results will be discussed.

4.1 Common method variance

First, this analysis begins with assessing the common method variance (CMV). Common method variance can be defined as variance that may be caused by the measurement method (Podsakoff *et al.*, 2003). In the situation where two or more constructs were measured using the same method, this may lead to an inflated or deflate correlations between constructs (Bagozzi and Yi, 1990). Harman's single factor test was used to address this issue and using the un-rotated factor solution and the result of this study indicates that five distinct factors accounted for 70 per cent of the variance. The first factor captured only 36 per cent of the variance in the data; hence, it can be concluded that common method bias is not a concern in this study.

4.2 Measurement model

To validate the measurement model, convergent validity and discriminant validity were assessed. Convergent validity assesses the degree to which a measure is highly correlated with alternative measures measuring the same construct (Hair *et al.*, 2014). Discriminant validity ensures that a construct measure is empirically unique and represents phenomena of interest that other measures in a structural equation model do not capture (Hair *et al.*, 2010). In this study, all the constructs were modeled as reflective construct; hence, the indicators should share a high proportion of variance (Hair *et al.*, 2014). Indicator reliability (outer loadings) and average variance extracted (AVE), and individual reliability (CR) as shown in Table II were examined to assess convergent validity. The loadings of most of the items were above the threshold value of 0.4. Three items (DC5, Inno5, Inno6) were deleted because their loadings were less than the 0.4 (Hair *et al.*, 2014). AVE values were all above 0.5, confirming the convergent validity (Hair *et al.*, 2010; Henseler *et al.*, 2009). Next, composite reliability (CR) was applied to assess the reliability of the measures, as it prioritizes the indicators based on their individual reliability. All the values of composite reliability CR were greater than 0.7 indicating that the measures were reliable. Hair *et al.* (2014) suggest that Cronbach's alpha estimates the reliability based on inter-correlations of variable's indicator whereas, composite reliability is based on the individual indicators. The discriminant validity was assessed by comparing the square root of the AVE values with the correlations of latent variables (Hair *et al.*, 2014; Fornell and Larcker, 1981). As shown in

No.	Construct	No. of items	Items deleted	Factor loading	AVE[a]	CR[b]
1	Digital orientation	4	None	0.867 0.844 0.787 0.807	0.684	0.896
2	Digital capability	5	1(DC 5)	0.870 0.838 0.865 0.782	0.704	0.905
3	Digital innovation	6	2 (Inno 5 and 6)	0.805 0.852 0.643 0.690	0.565	0.837
4	Financial performance	3	None	0.874 0.917 0.893	0.801	0.923
5	Non-financial performance	3	None	0.821 0.862 0.861	0.613	0.824

Notes: [a]AVE = (summation of squared factor loadings)/{(summation of squared factor loadings) + (summation of error variances)}; [b]Composite reliability = (square of the summation of the factor loadings)/{(square of the summation of the factor loadings) + (square summation of the error variances)}

Table II. Summary of construct validity and reliability of all construct

Table III, the square roots of AVE for each constructs were higher than the correlation for other constructs in this research, confirming the discriminant validity of the constructs.

4.3 Structural model

In this study, firm size and firm age are controlled as they might have effect on the hypothesized relationships. No significant effect of size and age of the firms was found on digital innovation. Therefore, the proposed relationships are verified regardless of firms' size and age. For hypothesis testing, structural model was assessed to evaluate the relationships between the variables. As shown in Table IV and Figure 1, direct effect of digital orientation ($\beta = 0.351, p < 0.01$) and digital capability ($\beta = 0.416, p < 0.01$) on digital innovation are significant and positive. Thus, *H1* and *H2* are supported. The R^2 value of 0.465 as shown in Figure 1 suggests that 46.5 per cent of the variance in digital innovation can be explained by digital orientation and digital capability.

Variable	1	2	3	4	5
Financial performance	*0.895*				
Digital innovation	0.350	*0.752*			
Non-financial performance	0.586	0.446	*0.783*		
Digital capability	0.380	0.619	0.489	*0.839*	
Digital orientation	0.462	0.592	0.515	0.579	*0.827*

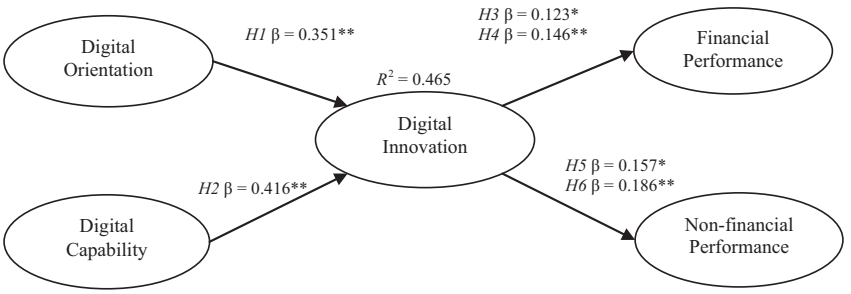
Note: Diagonals (in italic) represent the square root of average variance extracted (AVE) while the other entries represent the correlations

Table III. Discriminant validity

Table IV.
Hypotheses testing result

Hypotheses	Direct effect			Path coefficient	Standard error	*t*-value	Decision
H1	Digital orientation – product innovation			0.351**	0.108	3.252	Supported
H2	Digital capability – product innovation			0.416**	0.100	4.138	Supported
	Mediation effect	Path coefficient A	Path coefficient B	Indirect effect	Standard error	*t*-value	Decision
H3	Digital orientation – Digital innovation – Financial performance	0.351	0.350	0.123*	0.052	2.365	Supported
H4	Digital capability – Digital innovation – Financial performance	0.416	0.350	0.146**	0.046	3.174	Supported
H5	Digital orientation – Digital innovation – Non-financial performance	0.351	0.446	0.157*	0.067	2.339	Supported
H6	Digital capability – Digital innovation – Non-financial performance	0.416	0.446	0.186**	0.057	3.259	Supported

Notes: *Denotes significant at $p < 0.05$; **denotes significant at $p < 0.01$; Indirect effect = Path Coefficient A x Path Coefficient B; *t-values* = Indirect Effect/Standard error



Notes: *Denotes significant at $p < 0.01$; **denotes significant at $p < 0.05$

Figure 1.
Structural model

Next, mediation effect was assessed. In conformance with the non-parametric path modeling approach, a bootstrapping procedure was administered to test the significance of the mediating effect as suggested by Henseler *et al.* (2009) and Preacher and Hayes (2008) by using PLS-SEM approach. The mediation effect was computed using the formula – *t-values* = indirect effect/standard error. Therefore, the *t-values* of indirect effect were assessed to determine the mediation effect of digital innovation.

Table IV and Figure 1 depict the beta values of the indirect effects of digital orientation and digital capability on both financial and non-financial performance with product innovation as a mediator. Based on the results of significant indirect effect, *H3* ($\beta = 0.123$; *t-values* = 2.365); *H4* ($\beta = 0.146$; *t-values* = 3.174), *H5* ($\beta = 0.157$; *t-values* = 2.339) and *H6* ($\beta = 0.186$; *t-values* = 3.259) are supported as the *t-values* exceed the critical value of 1.645 at the 95 per cent significance level.

5. Discussion and implications

This study is conducted with two objectives: first, to examine the direct effect of digital orientation and digital capability on innovation; and second, to examine the mediating effect of digital innovation on the link between organizational performance and digital orientation, as well as digital capability in the context of IT firms in Malaysia. The proposed research model was tested to achieve the research objectives and also to answer research questions. The results provide an empirical evidence that support the conceptual model because all the hypotheses were supported. Therefore, this study achieves research objectives while answering research questions raised. Overall, our results support resource-based theory and dynamic capability theory that link digital orientation and digital capability to digital innovation.

To answer *RQ1*, *H1* and *H2* were tested. The results demonstrate that both digital capability and digital orientation have direct positive impact on digital innovation. Hence, *H1* and *H2* are supported by answering that digital capability and digital orientation are important driving factors of digital innovation. The significant positive effect of digital orientation on digital innovation is consistent with the previous finding of Yang *et al.* (2012) who found the positive effect of technology orientation on product innovation. This finding implies that digital orientation makes IT firms to put more emphasis on embracing digital technologies to better suit new digital needs of both businesses and consumers so that they can offer digital solutions that would change the business models and create new consumers' experience. Therefore, IT firms should foster digital mindset by first recognizing that digital technology is the powerful tool to disrupt industries and also by harnessing its tremendous potential to create new digital solutions to benefit industries and mankind. This

kind of digital mindset may help the firms in cultivating digital orientation that exhibits their commitment toward and acceptance of new digital technologies.

The significant positive effect of digital capability on digital innovation suggests that it is important for IT firms to enhance their digital skills in new digital product development to meet new customers' needs. This finding is in line with the finding of Zhou *et al.* (2005), who suggest that technology orientation is beneficial to technology-based innovation. In view of the importance of digital capability, IT firms should devote their resources to maximize their inherent capabilities by engaging in trainings, or by outsourcing, or having alliances or joint ventures with stronger players. Basically, digital capability could be built up with skills, talent, knowledge and experience related to managing digital technologies. Hence, IT firms need to attain and attract key digital talents who are experts. They should also develop in-house programs and digital skill building units to fill skills gaps. To retain and attract digitally capable experts, Lewis *et al.* (2004) suggest that HR professionals should develop new reward systems congruent with digital culture. As for policy makers, the findings suggest that government agencies should set initiatives of reskilling and upskilling of current workforce as well as training young generations for future workforce by exposing them to digital education at primary school or as early as possible. Furthermore, governments may consider more funding for digital upskilling of SMEs.

To answer *RQ2*, *H3*, *H4*, *H5* and *H6* were tested. The results show that digital innovation mediates the effect of digital orientation and digital capability on financial and non-financial performance. Hence, *H3*, *H4*, *H5*, *H6* are supported by answering the second research question that digital innovation translates digital orientation and digital capability into better organizational performance. The finding with regards to mediating effect of digital innovation in this study implies that firms which are committed to embracing digital technologies and improve their capability to better manage the digital technology are more likely to develop innovative digital solutions that in turn improve their organizational performance. Especially in ICT industry, where the technology is fast-changing and products get obsolete rapidly, it is time for the IT firms to nurture digitally orientated culture to respond to technology push and stay competitive. In particular, the significant mediation effect of digital innovation highlights that digital innovation is instrumental in translating digital orientation and digital capability into better financial and non-financial returns. Overall, the finding underlines that digital strength of a firm must be leveraged into digital innovation that could in turn boost the firm's performance.

6. Limitations and direction for future research

As is usually the case, some potential limitations of this study should be explicitly recognized and taken into account when interpreting its findings. This study focuses on only two crucial technological factors – digital orientation and digital capability. This limitation gives opportunity to future researchers of digital innovation to delve into other possible technology-related drivers of digital innovation such as technological culture as well as other organizational factors that could trigger innovation, and market-related factors that suit growing digital needs of users. Furthermore, this study draws data from a single industry that could limit the generalizability of the findings. Nevertheless, the findings are sufficiently robust to provide empirical support for the direct explanation of digital innovation and indirect explanation of organizational performance by digital orientation and digital capability.

7. Conclusion

Understanding the driving factors and performance impact of digital innovation is important to the IT firms because they are the key providers of digital solutions that digitalize the firms in other industries and their innovation will further ignite the innovation in other industries. Theoretically, this study extends resource-based view (RBV) in digital innovation context by empirically showing the important drivers of digital innovation that in turn contributes to performance. With regards to the research direction for digital innovation and digital technology, Agostini and Nosella (2017) note that the role of digital technologies in the innovation process has called the attention of scholars to provide further theoretical and empirical contributions. In addition, Yoo *et al.* (2010) invite scholars to provide strategic and innovation frameworks in a digital technology context. This study responds to these research calls by presenting and testing a new digital innovation model that could be further extended by future researchers. Moreover, this study fills literature gaps mentioned in earlier sections. One of the most critical literature gaps is that no study was found to have explained how digital technologies can be leveraged by IT firms to make innovative digital solutions and what performance impact digital innovation could have. Furthermore, there is a lack of literature on driving factors of innovation, particularly in digital context. Therefore, the present study adds value to the digital innovation literature by bridging these literature gaps and offers an avenue for future researchers to extend the research model.

Practically, this study contributes to the firms in similar industries by highlighting the crucial need to nurture digital-oriented culture and boost up capabilities to manage digital technologies to offer innovative digital solutions. Understanding the driving factors and performance impact of digital innovation would encourage the firms to take advantage of technological opportunities to enhance both level of innovation and business performance. It is also important for the firms to cognizant about the mediation effect of innovation because many firms are not putting their best effort in digital innovation probably because of lack of assurance of performance outcomes of innovative digital solutions. The more the firms realize the potential benefits of digital innovation and how it can be driven, the more likely they will go for it. Moreover, findings of this study may be a good reminder for the IT firms that it is time to analyze their technological needs and product needs to stay ahead, while setting the company's culture and mindset that should be open toward new digital technologies for new digital demands. Importantly, IT firms need to help their client business firms extract real business value from digital solutions because many business leaders have started to recognize the importance of digital solutions to their organization, but they could be incapacitated in strategically managing the digitalization process to create new values. By helping them, innovative digital solutions would better enable the digital transformation of industries to optimal level and subsequently expedite the journey toward digital economies.

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